Since the materials for this first volume were collected, the same authors have found especially in the wild life of South America and of Asia materials for these and for more profound and exhaustive studies which from time to time will be published in succeeding volumes of *Zoologica*.

The present work contains 436 pages and 138 illustrations. These collected papers are handsomely bound, for free distribution to certain of the libraries which exchange with the library of the Zoological Park, and for sale to other institutions. The volumes appear under the editorship of Henry Fairfield Osborn, president of the society, with the assistance of Elwin R. Sanborn, and may be purchased by application to the secretary of the Zoological Society, New York Zoological Park.

Henry Fairfield Osborn

May 29, 1919

SPECIAL ARTICLES

THE REASON MEAT INCREASES OXIDATION IN THE BODY MORE THAN FAT OR SUGAR

Lavoisier[1] showed that the ingestion of food increased oxidation in the body. Rubner[2] found that of the food materials, the ingestion of meat increased oxidation most, fat next and sugar least. Several theories have been advanced in attempts to explain how food increases oxidation in the body. The one most generally accepted seems to be the theory, or some modification of the theory, of Voit, who claimed that the presence of increased quantities of food materials augmented the inherent power of the cells to metabolize. We[3] found that the ingestion of food produced an increase in catalase, an enzyme possessing the property of liberating oxygen from hydrogen peroxide, by stimulating the alimentary glands, particularly the liver, to an increased output of this enzyme, and that the ingestion of meat, in keeping with its greater stimulating effect on heat production, increased catalase more than fat or sugar. It was found that the amino acids, the essential constituents of meat or protein, were responsible for the stimulating effect of the proteins, the simple sugars for the stimulating effect of the starchy foods and the neutral fats for the stimulating effect of the fats. We found, also, that by whatever means oxidation was increased in the body, there resulted a corresponding increase in catalase. Hence, the conclusion was drawn that the increase in oxidation following the ingestion of food, as well as the increase in oxidation produced in other ways, was due to an increase in catalase.

TABLE I

Material Used	Protein Constituents			Fat Constituents			Sugar
	Glycocoll	Sodium Acetate	Acetamid	Olein	Glycerine	Potassium Oleate	Dextrose
Percentage increase in catalase	56	36	48	40	43	31	24

The object of the present investigation was to determine why the amino acids, the essential constituents of protein, stimulate the alimentary glands, particularly the liver, to a greater increase in catalase, with resulting greater increase in oxidation, than does fat, and why fat produces a greater increase than sugar. The animals used were dogs. The amino acid, glycocoll, and two related compounds, acetamid and sodium acetate; the fat, olein and its constituents, glycerine and oleic acid; and the sugar, dextrose, were the materials used. Ten grams of the sugar and of the amino acid and five grams of the fat, per kilo of body weight, were used.

After etherizing the animals, an incision in the abdominal wall was made and the material to be used was introduced in about equal quantities, into the stomach and upper part of the small intestine, by means of a hypodermic syringe. The catalase in 0.5 c.c. of blood taken from the liver was determined before as well as at intervals after the introduction

[1] Lavoisier, *Mem. de l'Acad. des Sc.*, 1780.

[2] Rubner, "Energiegesetze," 322.

[3] Burge and Neill, *The American Journal of Physiology*, Vol. 46, No. 2, May, 1918.

of the material into the stomach and intestine. The determinations were made by adding 0.5 c.c. of blood to 50 c.c. of diluted hydrogen peroxide in a bottle at approximately 22° C. and the amount of oxygen gas liberated in ten minutes was taken as a measure of the amount of catalase in the 0.5 c.c. of blood.

The maximum increase produced in the blood of the liver by the different materials is given in Table 1. It may be seen that the amino acid, glycocoll, produced 56 per cent. increase in catalase, sodium acetate 36 per cent. and acetamid 48 per cent. increase. By comparing the formulæ of these three substances it may be seen that all three are derived from acetic acid; the amino acid, glycocoll, CH_2NH_2COOH, and acetamid, CH_3CONH_2, being acetic acid, CH_3COOH, with an amino (NH_2) group introduced into the molecule while sodium acetate, CH_3COONA, has the element sodium introduced, hence the conclusion was drawn that the introduction of the amino (NH_2) group into the molecule of the organic acid, acetic, thus forming the amino acid, glycocoll, as well as acetamid, was to increase the effectiveness of the acetic acid molecule in stimulating the liver to an increased production of catalase with resulting increase in oxidation. If the introduction of the amino (NH_2) group into the other organic acids, propionic, valerianic, caproic, succinic and glutaric, thus forming the amino acids, the essential constituents of protein, increases the effectiveness of these acids in stimulating the liver to an increase output of catalase, this may explain the great increase in heat production after the ingestion of protein.

It may be seen further in Table 1, that the introduction of olein, a fat, into the alimentary tract produced 40 per cent. increase in the catalase of the blood of the liver, glycerine 43 per cent., and potassium oleate 31 per cent. increase. By comparing these figures it may be seen that glycerine produced a greater increase in catalase than did the olein and that potassium oleate produced a smaller increase. By comparing the formulæ of these substances it will be seen that the fat, olein, $(C_{17}H_{33}COO)_3C_3H_5$, has in its molecule a part of the glycerine, $C_3H_5(OH)_3$, molecule and a part of the oleic acid, $C_{17}H_{33}COOH$, molecule. Since oleic acid or potassium oleate produces a smaller increase in catalase than the olein, and glycerine a larger increase, it follows that the effect of the glycerine radical in the olein molecule was to increase the effectiveness of the fat in producing an increase in catalase in a manner similar to but not so extensive as did the amino (NH_2) group in the amino acids. It may be seen that the sugar, dextrose, produced a smaller increase in catalase than any of the other substances in keeping with the fact that the ingestion of sugar produces a smaller increase in oxidation than fat or protein.

Evidence is presented in this paper to show that the increased heat production following the ingestion of food is due to the stimulation of the liver to an increased output of catalase, the enzyme bringing about the oxidation and that meat or protein, in keeping with its greater stimulating effect on heat production, produces the greatest increase in catalase, fat next and sugar least. The amino (NH_2) group in the protein molecule renders protein, or meat, a more effective stimulant on catalase production and hence on heat production than fat and the glycerine radical in the fat molecule renders fat more effective than sugar.

W. E. BURGE

THE BUFFALO MEETING OF THE AMERICAN CHEMICAL SOCIETY. II

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

H. S. Miner, *Chairman*

H. E. Howe, *Secretary*

Symposium on Library Service in Industrial Laboratories

The public library in the service of the chemist: ELWOOD H. MCCLELLAND, Technology Librarian, Carnegie Library of Pittsburgh. The function of the public library is to serve its public by affording information relating to the problems of the